clothing of men's bodies, as in the nurture of their minds, the difference between our own times and those of, say, the Stone age is obviously enormous; and—though this may be less obvious—the difference largely depends upon cellulose. For, not to mention high explosives and celluloid articles, if paper and papyrus, if cotton, flax, and similar textile materials are taken from us, we are back in the days of potsherd writing-tablets, woad, and fig-leaves—back, in fact, to an early stage of civilisation.

Typically cellulose is the purified fibre substance of cotton. Wood-pulp is a special combination of cellulose. In the fibres of wood, the cellulose is associated with substances which have the essential chemical characters of the di-ketones, and hence are designated "lignones." These are chemically much more reactive than the cellulose. Lignones, for example, are very susceptible to oxidation, even by the oxygen of the air, in this respect differing notably from cellulose. Hence paper such as modern "news" paper, which contains ligno-celluloses from wood-pulp as a constituent, on exposure to air and light becomes readily discoloured, and loses its tenacity. The ligno-celluloses are the essential fibrous components of "mechanical" pulp, which is merely wood disintegrated into its constituent fibres by grinding. On the other hand, since lignone is attacked by chlorine, by alkalis, and by alkali bisulphites, it can be separated with these reagents more or less readily from the cellulose with which it is associated, leaving the latter substance in a tolerably pure condition. This product is "chemical" wood-pulp ("soda" or "sulphite" pulp); it differs materially from, and is superior to, the fibre obtained by the mechanical process. Common "news" paper contains about 80 to 90 per cent. of mechanical wood-fibre, and 10 to 20 per cent. of wood-fibre which has been treated chemically; in high-class "news" paper these proportions are reversed. Naturally, "mechanical" wood-pulp is excluded from paper intended for permanent documents. It serves a useful purpose, however, in enabling the demand for cheap publications to be met.

Since cellulose in a more or less pure form can be separated from wood as "chemical" wood-pulp, the question naturally arises whether such pulp cannot be used as a source of cellulose for the production of textile fabrics, high explosives, and celluloid articles. Its relatively low price would seem to give it a considerable advantage. In fact, some success has been met with in respect of the first-named group; for example, in the manufacture of wood-pulp yarn ("silvalin") and of artificial silk (from "viscose"). But the shortness of the fibres is a serious limitation to the use of wood-celluloses for textile purposes. As regards the other groups, wood-cellulose when nitrated has been found to be less stable than cotton-cellulose nitrated to the same degree, and is therefore less suitable for these industrial uses.

The chief woods employed for the manufacture of "sulphite" and "mechanical" pulps are spruce, fir, and pine. For the production of "soda" pulp, aspen, conifers, poplar, and other deciduous trees are utilised; whilst hemlock wood is much used in the making of wrappers and "fibre" papers. After two introductory chapters, the authors discuss the sources of supply of such woods, and then proceed to describe the various operations involved in the manufacture of the several kinds of pulp. The rest of the book deals chiefly with the conversion of the pulp into paper and cardboard, and with its relation to the textile industries.

Professedly the work is written for the general reader, but there is much in it that would be appreciated by the young chemist beginning to specialise in cellulose products. Occasionally the style is heavy and not too clear; but the volume as a whole gives a good general idea of the wood-pulp industry, and the authors' names are a guarantee of its trustworthiness.

C. SIMMONDS.

DR LUNGE AND THE LEBLANC PROCESS OF ALKALI MANUFACTURE.

The Manufacture of Sulphuric Acid and Alkali with the Collateral Branches: a Theoretical and Practical Treatise. By Prof. G. Lunge. Third edition. Vol. iii., Ammonia-Soda, Various Processes of Alkali-making, and the Chlorine Industry. Pp. xix+764. (London: Gurney and Jackson, 1911.) Price 30*s*. net.

THESE handsome volumes, which we owe to the tireless industry of the emeritus professor of technical chemistry in the Federal Polytechnicum of Zürich, bring the history of the development of alkali manufacture and of its associated industries down to its latest phase. During the dozen or more years which have elapsed since the appearance of the last edition of Dr. Lunge's monumental work, considerable changes have occurred in this department of chemical technology which bid fair, in the fulness of time, completely to revolutionise its methods. A significant feature of modern manufacturing industry is the ever-growing application of electrical energy to its processes, and in no field of production has this application been more fruitful in consequences than in that of industrial chemistry. Although there is, even now, scarcely a single section of applied chemistry which has not felt the influence, directly or indirectly, of this form of energy, it is almost a truism to assert that we are only at the threshold of the new departure.

Dr. Lunge's books bring the story as far as the parting of the ways. He is the faithful chronicler of contemporary achievements, the historian *temporis acti*. He is concerned mainly in giving as full and as accurate a picture of the state of alkali manufacture at the end of the first decade of the twentieth century as is possible to him. As a faithful reflex of the present state of this manufacture the volumes before us suffer from the limitation that they deal only with what have grown to be subordinate processes—that is, processes which are dependent upon the conversion of common salt into alkali through the instrumentality of oil of vitriol, or, in other words, the Leblanc method of manufacture and its associated industries. The supremacy of this method has long since passed away by reason of the elaboration and development of the ammonia-

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soda process of Dyar and Hemming. The Leblanc process lives mainly on account of the commercial value of its by-products, but its continued existence even from this cause is seriously threatened by the rapid extension of the methods of producing electrolytic chlorine. Dr. Lunge, no doubt, has it in contemplation to complete his picture by the republication, revised and enlarged, of the third volume of the former edition of his work, in which he dealt with what was then publicly known of the methods of carrying out the ammonia-soda process, as developed by the Solvays, their coadjutors and successors. The appearance of this volume will be awaited with great interest.

In its essential features this edition differs in no material particular from its predecessors. The plan of the original work is substantially unchanged. During a large portion of his long career as a technologist, Dr. Lunge was intimately associated with the practical conduct of the Leblanc process—a process which was nowhere more successfully worked than in England, which constituted, indeed, the chief of our chemical industries, and brought in the aggregate great wealth to those concerned in it. The quondam head of the chemical department of the famous school of technology at Zürich long ago constituted himself the historian of this time-honoured process, which, whatever the future may have in store for it, will always be accounted as one of the most considerable and important of the manufacturing methods of which chemical technology has any record. It occasionally happens that threatened processes, like threatened men, live long. We may express the hope, then, that the days of the Leblanc process are not numbered, and that Dr. Lunge may still long be with us to note and chronicle the changes which may come over it.

GEOMETRY AND ALGEBRA.

(1) *A New Geometry.* By W. M. Baker and A. A. Bourne. Pp. xxii+246+vi. (London: G. Bell and Sons, Ltd., 1911.) Price 2*s.* 6*d.*

(2) *Algebra. Part II., for the Use of Students preparing for the Intermediate and Previous Examinations of Indian Universities.* By Prof. K. P. Chottoraj. Pp. iv+486. (Simla, Calcutta: A. K. Chottoraj, 1910.) Price 1.12 rupees.

(3) *Parametric Coefficients in the Differential Geometry of Curves.* By Dr. S. Mukhopadhyaya. Pp. 31. (Calcutta: The University, 1910.)

(1) THIS text-book is an abbreviated and condensed form of the well-known work by the same authors published eight years ago, and therefore requires little comment. The suggestion made in the Board of Education circular on the teaching of geometry that propositions should so far as possible be taken in groups has been adopted. Thus theorems on parallels form the first, properties of a single triangle the second, tests for congruence the third, and constructions the concluding section of book i. The authors have throughout included considerably more material than is required by the Cambridge schedule, particularly in reference to proportion and areas. The last fifty pages of the book are devoted to solid geometry. The properties of line and planes are treated in a fashion very similar to Euclid XI.; this is followed by a number of properties of the tetrahedron, pyramid, cylinder, cone, and sphere. An excellent collection of examples on the mensuration of solid figures is included.

(2) The subject-matter of this volume ranges from quadratic equations to the exponential and logarithmic series, and in doing so covers more than four hundred closely printed pages. It is therefore evident that the treatment is very thorough. There is indeed far too much detail; all sorts of special and artificial cases are dealt with, apparently in order to fortify the student against every possible difficulty he may be likely to encounter. For those whose sole object is to pass examinations this may be advantageous, but on general grounds it is highly undesirable. The author has a lucid style, and has evidently arranged both the text and the examples with the greatest care. His book should be most useful to the teacher, but we are inclined to think it will be rather oppressive for the student.

(3) This pamphlet is the result of a series of investigations the author has made in differential geometry. The method of parametric coefficients was evolved from an attempt to obtain by elementary means expressions for the radius of curvature and aberrancy in terms of the arc. The first part of the paper deals with the properties of parametric coefficients of *n*-dimensions, and then applications are made to plane curves; these include the deduction of the equation of the osculating cubic and the general differential equation of the cubic. It is stated that additional applications will be found in a further paper by the author which will be published shortly.

MECHANICS AND TESTING OF MATERIALS.

(1) *Elements of Mechanics, with Numerous Examples for the Use of Schools and Colleges.* By G. W. Parker. Pp. ix+245. (London: Longmans, Green, and Co., 1911.) Price 4*s.* 6*d.*

(2) *A Handbook of Testing.* By Prof. C. A. M. Smith. Materials. Pp. xii+284. (London: Constable and Co., Ltd., 1911.) Price 6*s.* net.

(1) THIS book is intended for the use of students having only a comparatively elementary knowledge of mathematics; great care has been taken to ensure that the student should acquire thoroughly clear ideas of the first principles which form the groundwork of the subject, and this has been borne in mind in working out the numerical examples illustrating the various laws. The first part of the book is devoted to statics, the branch of the subject of perhaps the greatest importance to the engineer; composition and resolution of forces in one plane, moments of forces, parallel forces, couples and their composition, centres of gravity, and conditions of equilibrium are successively dealt with, and then the application of the laws, which have been deduced, to

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